

Chapter 5: Suggestions for Further Research

5.1 Introduction

This chapter will address the question of how the “theory functions” model of citation introduced in the last chapter might be further explored and developed, as some of the findings presented there merit additional investigation and elaboration. For example, the characteristics that promote diffusion of theories are markedly different from those that promote innovation diffusion in general, and represent an intriguing challenge for diffusion researchers. These theory characteristics also appear surprisingly interdependent, in that they all mediate and are mediated by “accessibility” in a way that classic innovation characteristics have not been shown to do.

These findings afford an avenue for additional research on both the epistemology of theories and the importance of “shared cognition” in the context of justification, as the classic models of theoretic communication discussed in Chapter 2 have not proven to be representative of the cases investigated in this study. First, however, some potentially important and immediately practical applications for the model will be discussed in the following section.

5.2 Practical Applications for the Theory Functions Model

This dissertation’s attempt towards identifying how specific theory characteristics may help in determining diffusion patterns or “careers” offers an opportunity to expand the scope of current bibliometric research activities, by focusing on why as well as how theories are communicated. The theory functions model could help in the assessment of scholarly productivity at the individual, group, and disciplinary levels.

At the individual level, the model would provide a more qualitative approach to the evaluation of scholarly productivity, by expanding the current emphasis on absolute citation counts to include any actual “theory functions” of those citations as well. This would allow the evaluation of how a scholar’s own theories are being developed or (perhaps more commonly) how the scholar has contributed to the development of the theories of others.

At the group level, the model, were it to add specific sub-categories reporting the results of empirical analysis within the empirical data category as discussed earlier, could be used to compare the successes of competing theories in a single area as part of a national or international research policy agenda setting process. In her discussion of “social empiricism,” Miriam Solomon has suggested that such an approach is more likely to result in rapid advances in fields of critical importance (Solomon, 2001). The model could easily be expanded to provide the framework for such an objective approach, particularly because, as Solomon points out, the optimal time for such evaluation is before consensus on any particular theory has been reached, rather than after (Solomon, 2001, page 118). The “theory functions” model in fact provides a more flexible framework for such analysis than, for example, current meta-analytic techniques, in that it could assess qualitative as well as quantitative approaches.

And, finally, at the disciplinary level, another potentially significant use for the “theory functions” model would be to apply it to new publishing paradigms. Although the most common method of late for the analysis of theory diffusion has been through citation analysis, the model presented here could be used in the study of the diffusion of theories through any communication medium. One interesting avenue of investigation would be to use the model in the analysis of the evolution of a particular manuscript through the succession of reviewers’ comments regarding its relationship to a specific discipline. Another, more public, approach might be to use the model to assess the progress of a theory (and its rivals) through a listserv or electronic archive devoted to a particular discipline.

Of course, the most general application might be to compare the varying progress of those particular aspects of “theory work” described in the model through different communication channels across disciplines. For example, do reports of empirical investigations achieve faster publication in one area of psychology than in another, and does that affect the “career pattern” of the theories involved? Or does the emphasis on applied usage of a theory in another area of psychology affect the “career pattern” of other theories without immediate

application in that area? These questions could be relatively easily explored using the model and the techniques developed in the current study. Continuing the emphasis on practical applications, the next section discusses the potential for a more generalized “theory functions” model to be utilized in the analysis of different types of theories “at work” in the world.

5.3 A Generalized Theory Functions Model

Although the citation functions typology and resulting model were developed in the process of analyzing specific theories in a specific domain, and it is unlikely that all of its features would apply in their entirety to any other domain, it seems reasonable to suggest that a similar effort towards investigating different domains might also uncover additional important theory functions, leading to a stronger and more general model of theory functions of citation than the one presented in this exploratory study. This more comprehensive “theory functions model of citation” would obviously be of substantial interest in a variety of investigations, and this project would be a logical step for future research.

The illustrative typology of previous theory career and context studies shown earlier in Figure 1.4 of Chapter 1 provides many excellent examples of the value and the possibilities of such an independent approach to the study of theories at work. For instance, to choose a single example, Edna Reid’s work on terrorism research (Reid, 1993, 1997) opened an important and almost unlimited field of endeavor in which the diffusion of these theories could be investigated. Similarly, those epistemic communities discussed in Chapter 2 all provide largely unexplored territory for future development of the “theory functions model” of citation, whether one’s interest is in law or literature, economics or engineering.

However, the intention of this dissertation was also to help in an effort towards fusion of the separate traditions of diffusion research, bibliometric research, and epistemological research. As an inquiring system itself, a “theory functions model” might offer substantial benefits as a subsystem applied to any or all of the three research programs. These three research programs might also offer substantial benefits in promoting “theory functions” research in the study of the

diffusion, visualization, and epistemology of “theories at work” in a much broader range of environments than those explored in this dissertation.

Therefore, the approach taken in the remainder of this chapter will be to briefly describe three exemplary research programs in these separate research traditions and discuss how a model of “theory functions” might be applied to each in order to enrich their findings. The specific research programs to be discussed here include “constructuralism,” “domain visualization,” and the “multicoherence theory of knowledge.”

“Constructuralism,” a unified theory of the communicative interaction cycle that is one of the most sophisticated models of diffusion presently available, was introduced by Kathleen M. Carley and David Kaufer of Carnegie-Mellon University. “Domain visualization,” which is considered an important advance in bibliometric research in that it allows the researcher to dynamically “map” knowledge activities, has recently been much enhanced by the exertions of Chaomei Chen at Drexel University. The cognitive science projects of “explanatory coherence” and, more recently, “the multicoherence theory of knowledge” have been furthered by Paul Thagard of the University of Waterloo as part of his program of computational philosophy of science, a long-standing epistemological research endeavor. Again, these three research programs have been chosen as exemplars of the best recent theoretical work in diffusion, bibliometrics, and computational epistemology.

5.4 Constructuralism

In their seminal work, *Communication at a Distance*, David Kaufer and Kathleen Carley integrate agents, content, and context as components of a sociocultural ecology that evolves over time (Kaufer and Carley, 1993, pages 87-88). This unified theory of the communicative interaction cycle, which they term “constructuralism,” is suggested as a more satisfactory meso-theoretical approach than either of the two pre-eminent communication research traditions: the empirical (*e.g.*, mass communications theory) and the humanistic (*e.g.*, reader-response theory). Both of these separate traditions tend to make the specific communicator, the audience, the

communication, the communication technology, or the communicative effect the object of inquiry. Both traditions, therefore, tend to “black-box” the communicative transaction itself.

Further, while the empirical communication research tradition functions ahistorically, in accordance with the social scientific research tradition from which it stems, the humanistic research tradition is historically specific in its concern with individual authors, in accordance with classic literary research tradition. Consequently, both traditions neglect the continuities of social and cultural organization arising from the circulation of information through concurrent transactions unfolding over time (Kaufer and Carley, 1993, page 3). In contrast, the constructivist approach, which “. . . makes individual cognition (specifically, individual information; the ability to learn and to choose interaction partners with whom to learn) the central showpiece [in which] . . . the slightest change in what an individual knows can, in principle, affect the entire sociocultural landscape,” also allows the aggregation of the communicative transactions which dynamically structure a given social world over time (Kaufer and Carley, 1993, page 90).

Kaufer and Carley point out the critical centrality of print in modern sociocultural organization and change, appreciating in particular the influence of such predecessors as Eisenstein (1979), Goody (1986), Innis (1950, 1951), McLuhan (1962, 1964), Ong (1982), and Yates (1966) in exploring the impact of old and new media on basic cognitive and cultural organization for understanding information, from units organized by the oral/aural senses to units organized by the visual senses. Similarly, they acknowledge the importance of such social theorists as Archer (1988), Collins (1975), Giddens (1984), and Turner (1988), all of whose work explore in various ways the “meso-structure” between the micro-interactions of individuals and the macro-structures of society (Kaufer and Carley, 1993, page 206). However, constructivism itself can be profitably viewed as a structural theory of information diffusion, with ties to classic work in diffusion theory (Katz *et al.*, 1963; Rogers, 1962), information use theory (Feldman and

March, 1981; Festinger, 1956), social network theory (Burt, 1983; Granovetter, 1973; Pool and Kochen, 1978; White and Breiger, 1975), and scientometric theory (Holton, 1978; Price, 1970).

Constructuralism provides a dynamic model of the communicative transaction cycle as it impacts and is impacted by the particulars of any sociocultural topology. It specifically foregrounds “adaptation” by social groups in consonance with its emphasis on change over time, with three specific “measures of adaptation” at the sociocultural level: diffusion, stability, and consensus (Kaufer and Carley, 1993, page 148). Diffusion is a longitudinal measure of the fraction of the population that has received some new information or innovation. Stability is the degree to which the population shares available information. Consensus is the degree to which the population shares the same belief about some focal idea or decision point.

Constructuralism, thus, is a generic process model which Kaufer and Carley employ in a series of historically-informed, computer-assisted *gedanken* experiments that model the movement of texts as artificial agents in simulated societies of oral and print-oriented communicators, professional communicators, and academic communicators. As the intent of these simulations is theory development, framed by high-level historical accounts and the operationalization of these accounts into a set of models that furnish insight into how the accounts need further elaboration and revision, constructuralism is very much a work in progress (Kaufer and Carley, 1993, page 8).

In a critique of self-organizing systems research in the social sciences, including both constructuralism and autopoiesis, Noshir Contractor points out that such models run the risk of being more metaphorically appealing than theoretically or empirically revealing (Contractor, 1998). The considerable difficulties in modeling communicative complications are exemplified in Niklas Luhmann’s attempt to use autopoiesis to model communication systems such as law (Luhmann, 1982, 1995). Autopoiesis has made little progress to date in modeling a real-world legal knowledge system or in fitting actual or *gedanken* data to its parameters (Baxter, 1998).

One of the more fascinating features of the constructuralist model is the specification of the text as an artificial agent encapsulating part of its author's mental model during the time of composition, and subject to later, local interpretation during communicative transactions. In the academic simulation, this specification is termed the "theory of engineered reach" and makes a distinction between context-related (prestige of author and/or journal of publication) and content-related resources available to authors (Kaufer and Carley, 1993, pages 380-1). Authors' content-related resources for creating their textual agents consist of "citation" (the use of authors' names to relate the textual content to the ideas of other authors in the field) and "elaboration" (the use of sentences to expand more fully than citations upon the ideas of prior texts). Kaufer and Carley quantify both citation and elaboration in a test of their "engineered reach" model (Kaufer and Carley, 1993, pages 385-391). The neglect of citation and elaboration quality in their model presumably contributes to the inconclusiveness of their results.

What is not at present factored into constructuralism's textual agent is any potential power or truth-value of those new ideas embodied in the text itself. While avoiding the danger of a simplistic evolutionary epistemology such as Dawkin's concept of "memes" (self-validating ideas as controlling parasites on the brains of their human hosts) which has been both popularized (Blackmore, 1998) and debunked (Polichak 1998), the textual agent comes precariously close to foundering on a purely social construction of truth as an emergent property of subsequent local interpretations. It is unlikely that the current model of constructuralism would be able to explain much about the actual import and impact of the ideas of, for example, Darwin, or even Derrida, without attending to larger issues of private or public standards for credibility.

A further weakness of the constructuralist model is that it tends to present the communication landscape as a level plain, without the complications introduced by the dynamics of various knowledge systems and their interrelationships. Although this is an inherent feature of models, advances in constructuralist research beyond what is already available through standard

diffusion research or network analytic techniques will obviously require the introduction of appropriate cognitive and communication complications.

Carley's more recent constructuralist work has focused specifically on the effects of communication technologies on cultural homogeneity, consensus, and the diffusion of new ideas, but continues, largely due to the explicitly statistical nature of the current constructuralist model (Carley, 1995, page 569), to neglect the ontological and sociological aspects of knowledge. It is a celebrated cognitive paradox, however, that an idea must be believed, however briefly, in order to be understood, and that an idea must be understood, however imperfectly, in order to be believed (*e.g.*, Gilbert *et al.*, 1990, 1993). Any model of knowledge utilization that fails to specify the boundaries of credibility within a particular knowledge system is unlikely to be as useful as one that makes that attempt.

"Complicating" constructuralism with the appropriate theory functions model as part of the "engineered reach" for a particular domain would assist greatly in allowing it to make sense of empirical citation data and offer a more realistic diffusion model. In particular, the differences in diffusion patterns suggested by certain theory characteristics discussed in Chapter 4 (for example, the "narrow, deep diffusion" pattern suggested by a theory with strong "constructivity," as opposed to the "wide, shallow diffusion" pattern suggested by a theory with strong "applicability") is well worth investigating in terms of the social structure of scholarship.

5.5 Domain Visualization

The bibliometric research program to be discussed next employs a generic knowledge visualization approach that uses membership nominations by network participants to track network development over time. The "domain visualization" approach of Chaomei Chen and his co-authors (Chen 1999a; Chen *et al.*, 2001, 2002, 2003; Chen and Paul 2001) focuses on the dynamics of a specific scientific domain or discipline as displayed by its actual self-organizing behavior. Chen has drawn on co-word analytic techniques associated with actor-network theory (Callon *et al.*, 1983), co-citation and author co-cocitation techniques associated with

scientometric theory (White and McCain, 1998), domain analysis techniques developed to optimize information-seeking by displaying paradigmatic groupings (Hjørland and Albrechtsen, 1995), and visualization techniques drawn from computer science (Chen, 1999b).

Not coincidentally, Chen's method relies extensively on data collected by the Institute of Scientific Information, with the limitations imposed by that organization's operations (Curry, 1996; Hicks 1999). He carefully differentiates his work, however, from the overarching "map of science" presciently proposed by Derek de Solla Price (Price, 1979) and only recently implemented by Eugene Garfield and Henry Small (Garfield, 1994; Small, 1999), by focusing his attention on the micro-structures of particular clusters rather than the entire macro-structure of science as displayed by its literature.

The domain visualization approach extracts structural patterns from the scientific literature as exemplified by citations in a particular discipline and represents them in a three-dimensional knowledge landscape that allows the user to quickly and intuitively identify areas of rapid intellectual development through watching clusters of highly-cited and co-cited scientific publications move into a "core" position within a co-citation network.

This is made possible through the extraction of citation data, the specification of a particular co-citation threshold, the use of principal component analysis on the correlation matrix of the co-citations involved combined with an analysis of the citation contexts associated with the cited authors, Pathfinder network scaling, and, finally, rendering of the networks in three-dimensional landscapes that can be displayed as time-series virtual reality models.

Chen claims that the use of a single key word or phrase such as "mass extinction" even by a user without any previous knowledge of the particular discipline involved may invoke the appropriate bibliographic data to set his paradigmatic map in motion by the use of his method. He does suggest, however, that the rendering of such a paradigmatic map requires cross-validation through other sources of information about the development of a particular area, as is common in other types of bibliometric studies.

This “domain visualization” approach seems to avoid Noshir Contractor’s criticism of self-organizing systems in general in that it is indeed empirically revealing. Disregarding any uncertainties introduced by well-known ambiguities of citation and non-citation practices within particular disciplines, and ignoring the biases and other weaknesses introduced by the reliance on ISI data, which is notoriously unrepresentative of the broader spectrum of world scientific literature, the primary objection to “domain visualization” as a complete approach to theoretic communication is that it is designed to display the external dynamics of an actual knowledge system in action but lacks any explanation of the proposed internal dynamics offered by the constructivism model of Kauffman and Carley.

Admittedly, algorithmic advances, perhaps incorporating stochastic models of predicted citation behavior such as those suggested by Quentin Burrell (Burrell, 2002, 2003) could eventually allow “domain visualization” to simulate various scenarios for the further development of particular clusters, but cannot offer any insights into the particulars of those theories “at work,” the human minds that employ them, or the particular circumstances that surround them.

This is most sharply emphasized by one of Chen’s sample data-sets, which he uses as an example of what he terms “latent domain knowledge”: that is, “highly relevant but relatively infrequently cited scientific works” (Chen, 2003, page 191). This example is that of Donald Swanson’s exploration of possible linkages between two logically related but bibliographically unconnected literatures, otherwise known as “undiscovered public knowledge” or UPK. The “latent domain knowledge” mappings indicate what is claimed to be the impact of Swanson’s work in connecting particular UPKs on the scientometrics and biomedical literatures. However, the visualizations do not indicate something that is made very clear in Mark Spasser’s 1997 examination of those same literatures through citation context analysis: that in fact the biomedical references shown by Chen are actually dismissive of Swanson’s claims rather than supportive of them (Spasser, 1997). Therefore, Chen’s statement that “the fact [is] that [one particular article of Swanson’s] is the gateway between the two disciplinary literatures [and that] he has also made a

strong connection between information science and medical sciences” (Chen, 2003, page 203) would be considered factually inaccurate by at least one of the fields he mentions. This could have been avoided by attending to citation context as well as network positioning. Mark Spasser, when responding to an inquiry about this issue, said, “I have always thought, especially when analyzing the ‘meaning’ of citations, that their contexts are crucially important, and meaning can only be analyzed qualitatively” (Spasser, 2003).

Ironically, Chen himself agrees with this claim. He has employed Henry Small’s concept of “specialty narratives” (Small, 1986) in another visualization of linkages, this one of the “passage of science” (Small, 1986) in which co-citation networks are transformed into a flow of ideas, which may then be mapped longitudinally. Although Small himself had originally hoped to automate the citation context analysis process, the complexity of the endeavor has to date eluded all but human analysts. Chen comments, “A specialty narrative is only meaningful if sufficient contextual information of citation is attached to the narrative. . . . In the foreseeable future, we will still have to rely on human intervention rather than automated algorithm devices, to make such selections” (Chen, 2002, page 150). The theory functions model, therefore, particularly the “connectivity” and “generativity” characteristics and those paths they may indicate regarding the trajectory of theory use, is exactly the kind of “lens” that could assist in helping “domain visualization” to become clearer and more focused.

5.6 The Multicoherence Theory of Knowledge

In recent years, Paul Thagard has extended his long-standing interest in computational philosophy of science (Thagard, 1988) beyond processes of scientific discovery (Thagard, 1990) and conceptual revolutions (Thagard, 1992) into the more generic context of justification. His approach differs from the diffusionist and bibliometric approaches in that he explicitly considers the goal of his model to be epistemic justification, which is the special concern of analytic philosophy, rather than the more generalized model of consensus building offered by Carley or of that of knowledge structure offered by Chen.

Thagard argues that the coherence theory of truth as discussed in Chapter 2 fails because we as rational beings must support the existence of a world independent of our thoughts of it, so that truth must be a matter of correspondence with this world. However, he also endorses the cognitive and especially the computational possibilities of construing the world as a “coherence problem,” in which coherence as constraint satisfactions of various types provides a new way of thinking about correspondence and approximate truth.

Thagard’s model is a so-called “multicoherence” theory of knowledge rather than truth, however (Thagard, 2002). It provides an abstract formal characterization that unifies numerous psychological theories with a mathematical framework that encompasses constraint-satisfaction theories of hypothesis evaluation, analogical mapping, discourse comprehension, impression formation, etc. He cites Russell’s justification of mathematical axioms, Goodman’s justification of logical rules, and Daniels’s justification of wide reflective equilibrium as other, domain-specific examples of multicoherence knowledge theory.

Thagard describes six different forms of coherence that contribute to his model: explanatory coherence, analogical coherence, deductive coherence, perceptual coherence, conceptual coherence, and deliberative coherence. Most important to his project, however, is explanatory coherence, the principles of which are as follows:

Principle E1: Symmetry

Explanatory coherence is a symmetric relation, unlike conditional probability. That is, two propositions p and q cohere with each other equally

Principle E2: Explanation

A hypothesis coheres with what it explains, which can be either evidence or another hypothesis. Hypotheses that together explain some other proposition cohere with each other. The more hypotheses it takes to explain something, the lower the degree of coherence

Principle E3: Analogy

Similar hypotheses that explain similar pieces of evidence cohere.

Principle E4: Data Priority

Propositions that describe the results of observations have a degree of acceptability of their own

Principle E5: Contradiction

Contradictory propositions are incoherent with each other.

Principle E6: Competition

If p and q both explain a proposition, and if p and q are not explanatorily connected then p and q are incoherent with each other (p and q are explanatorily connected if one explains the other or if together they explain something)

Principle E7: Acceptance:

The acceptability of a proposition in a system of propositions depends on its coherence with them.

Thagard also suggests that muticoherence can be understood in terms of maximal satisfaction of multiple positive and negative constraints, and shows how various constraints can be specified for evaluating hypotheses and other propositions. Positive constraints arise from relations of explanation and analogy that hold between propositions, and negative constraints arise either because the evidence is contradictory or because two hypotheses contradict each other to explain the same evidence.

He proposes five algorithms for maximizing coherence: an *exhaustive* search algorithm that considers all possible solutions, an *incremental* algorithm that considers elements in arbitrary order, a *connectionist* algorithm that uses an artificial neural network to assess coherence, a *greedy* algorithm that uses locally optimal choices to approximate a globally optimal solution, and a *semidefinite programming* algorithm that is guaranteed to satisfy a high proportion of the maximum satisfiable constraints.

The formal constraint-satisfaction characterization of coherence and the different algorithms for computing coherence suggest various means by which coherence can be measured: the degree of coherence of an entire set of elements, the degree of coherence of a subset of the elements, and the degree of coherence of a particular element. Unfortunately, though, none of these measures are completely satisfactory, although the number of cycles required for a network to settle into a steady state is probably the best existing measure for the coherence of an entire set,

while the activation of an individual unit represents the degree of acceptability of that unit, and the mean activation of those units represents the degree of coherence of that subset.

Thagard's claim is that multicoherence theory also avoids the well-known objections to coherence systems in general. Those objections, mentioned briefly in Chapter 2 above, include vagueness, indiscriminateness, isolation, conservatism, and circulatory reasoning. Thagard says that multicoherence avoids the charge of vagueness by arriving at a rich, coherent set of elements in a very complex process that intermingles both assessment of coherence and generation of new elements through the parallel-constraint satisfaction algorithm.

He also defends multicoherence against the charge of lack of discrimination. While "pure" coherence systems fail to allow that some kinds of information may deserve more weight than others and "foundational" coherence theories select certain privileged elements as self-justified, multicoherence may favor a particular set of elements due to the principle of observational data priority, but their acceptance still depends on their coherence with all the other elements in the system.

Isolation, in which a segregated set of beliefs may be internally consistent but fail to be externally supported by evidence, is also not a problem for multicoherence, Thagard claims, because it offers both discriminating criteria and negative as well as positive associative criteria, so that coherence can be temporarily maximized in some cases by adopting an inconsistent set of beliefs in the interests of truth. He offers the inconsistencies between quantum theory and general relativity as an example of the value of this in scientific inference (Thagard, 2000, page 74).

The criticism of conservatism, requiring that new elements must fit into an existing coherent structure, is avoided by the fact that his connectionist algorithm allows new elements that are sufficiently coherent with other elements to dislodge previously accepted ones, thereby activating new concepts in the system. And, finally, Thagard proposes that multicoherence avoids the "regress problem" of circular reasoning because it doesn't proceed in linear steps but rather by the simultaneous evaluation of elements.

Thagard's multicoherence theory of knowledge was first instantiated by a computer program (ECHO) that uses input about explanatory relations and contradictions to create a constraint network that performs the acceptance and rejection of propositions on the basis of their coherence relations. He has since developed a computational model that first evaluates coherence for each individual member of a group, and then performs a "coherence calculation" to check for the presence of group consensus among members. This coherence-based consensus computational model (CCC) has been tested in historically based simulation studies on the acceptance of the bacteria theory of peptic ulcer causation and on rival hypotheses (moon-capture, coaccretion, fission, and meteoric-impact) of the origin of the moon. Like the constructivist model, the multicoherence model is uncomplicated by issues of incomplete knowledge, erratic communication patterns, and differentiating and divergent cogitation preferences. Like constructivism, one weakness of Thagard's model is the inaccessibility of actual cogitating minds in naturalistic situations. Unlike constructivism, a further weakness and potential strength are the implicit assumptions of both rational cognition and fully shared epistemic values, neither of which is completely true of even the most homogenous and rigorously logical "invisible college." Unlike most other efforts at conceptual consensus system modeling (*e.g.*, Trochim, 1988), however, Thagard's goal as a philosopher is also to determine what makes for justified true belief.

Thagard further notes that the most pressing problem for the multicoherence theory of knowledge is the "intercoherence" problem that requires finding additional connections among the elements and constraints involved in the different kinds of coherence (Thagard, 2002, page 125). Thagard's projects have never involved the use of citation data, probably because of the ambiguities inherent in citation practices discussed throughout this dissertation. A focus on theory use, not citation use in general, would be most useful for his particular model. Again, the use of the "theory functions" of citations may assist in usefully "complicating" the multicoherence theory of knowledge by the use of actual data in actual contexts rather than by simulating

hypothetical thought processes of deceased scientists such as Galileo or Huygens or their imagined audience.

5.7 The Theory Functions Model

During the course of this discussion, we have noted that these three most contemporary efforts in diffusion, bibliometrics, and epistemology are computationally intensive, network-centric, and tend to neglect the qualitative aspects of cognition and communication in favor of more tractable and visualizable areas. This final section of the final chapter will briefly return to the proposed “theory functions model of citations” and consider why this might be the case.

It was noted in Chapter 2 that theories of truth themselves have become more or less commodified systems of justification. The theory characteristics model developed in Chapter 4 too can be considered from this perspective, and applied variously to the epistemic communities and their citation systems discussed previously in terms of which of the five main characteristics of the model might be given most “weight” in those communities.

As a matter of speculation, it seems worth suggesting that “constructivity” is most likely to be the defining characteristic around which invisible colleges in the sciences and, as shown in Chapter 4, even the social sciences, would crystallize, as the importance of being able to falsify a hypothesis is generally considered the hallmark of scientific discourse. In technology, “applicability” of an invention appears to be most likely to be the key factor, while in the legal system it seems reasonable that “connectivity” to existing legal precedents would predominate.

Empirical Factors	Social Factors	Theoretical Factors
Applicability (Technology)	Accessibility	Connectivity (Law)
Constructivity (Science)		Generativity (Philosophy)

Figure 5.1 Theory Characteristics Most Potentially Relevant to Diverse Knowledge Systems

In postmodern philosophy, at least in terms of the deconstructive turn we have examined here, “generativity” of new interpretations would appear to be most important. As the projects of Chen, Kaufer and Carley, and Thagard all belong more or less to the social sciences, as shown by their citation networks, it is likely that “constructivity” too has been the driving factor behind their individual endeavors, and their models indeed reflect that imperative. However, as we have seen, even theories of truth are in the process of evolving towards more integrative models, so it appears a reasonable expectation that, over time, these three theoretical programs as inquiring systems will also incorporate elements of other promising subsystems such as the “theory functions model of citation” in order to improve their own functionality. At any rate, that has been part of both the design and the desire of this dissertation project.